Accommodations Toolkit

Braille: Research

This fact sheet on **braille** is part of the *Accommodations Toolkit* published by the National Center on Educational Outcomes (NCEO). It summarizes information and research findings on braille as an assessment accessibility feature or accommodation.[1] The toolkit also contains a summary of states' accessibility policies for braille.

What is braille? Braille is a coding system using patterns of raised dots representing letters and words. Students with visual impairments, including complete blindness, can learn in their primary language, using the letter-by-letter codes for various written languages. For this fact sheet, the generic term "braille" refers to Unified English Braille (UEB) and Nemeth code—an alternate and associated form of numerical expression for mathematics and science academic content (American Printing House (https://www.aph.org/), n.d.). Braille has a simple form ("Grade 1" or uncontracted) with one-to-one correspondence between individual characters and letters, and a more complex or advanced form ("Grade 2" or contracted) where one character can represent multiple characters or words; in other words, Grade 2 uses standard contractions to save space and time (American Council of the Blind/ACB (https://acb.org/), n.d.).[2] Braille can be presented on thick paper or via refreshable braille display tools.

What are the research findings on who should use this accommodation? Students who are blind or have visual impairments should be provided braille as an assessment accommodation when: (a) it can be confirmed that they have already received instruction in decoding braille, and (b) they have been using braille in instructional or classroom settings. Further, the version of braille accommodation for assessments must match the version students typically use; that is, contracted UEB or Nemeth must not be provided to students who are only familiar with uncontracted UEB or Nemeth. According to Johnstone et al. (2009), the percentage of students who use braille technologies varies across schools; a higher percentage of students use braille technologies at schools for the blind than other schools.

What are the research findings on the implementation of braille? Seven studies were identified that addressed the use of braille as an accommodation.

- Three studies provided evidence about the impact of braille on assessment performance, indicating either benefits or no effects; none of the studies specified negative effects. Erin et al. (2006) found that blind high school students reading multiple-choice social studies items in braille scored higher than students with no visual disabilities reading standard print, and higher than students with low vision reading enlarged font. Similarly, Fox (2012) found that students with visual impairments using braille scored higher on average for most grade levels in both reading and mathematics than students with other disabilities who used other accommodations. The third study found, when adjusting for demographic factors, no significant difference between group mean scores for students using braille when compared with students using other mediums (e.g., standard font size, enlarged font size) (Jackson, 2003).
- One study (Bolt, 2004) found that braille does not alter the academic constructs being assessed. However, some item types in mathematics were more difficult to render in braille than others. In particular, students with visual impairments may need different instruction for spatial estimation-related content than other students.

- Bolt (2004) also found that the braille accommodation was neither more nor less appropriate for blind or visually impaired students with or without cognitive or intellectual disabilities.
- One study found that refreshable braille screen displays had difficulty presenting some punctuation symbols in basic braille (uncontracted) for young students during testing of reading narrative text. Students' braille levels (uncontracted or contracted) and their academic reading levels need to align (Kamei-Hannan, 2008).
- Erin et al. (2006) found that it took students longer to complete assessments with braille than with recorded oral delivery.
- Stone et al. (2010) studied the validity of braille and large print format accommodations by comparing the performance of 4th and 8th grade students on a large-scale English language arts assessment. They found that students with and without disabilities taking the test under standard conditions and students with visual disabilities using braille or large print format all performed similarly, suggesting that the use of the accommodations improved accessibility while not adversely affecting the validity of the assessment.

What perceptions do students and teachers have about braille? One research study examined student perceptions about the use of braille.

- Erin et al. (2006) found braille formats are preferred over orally delivered assessments by students who know braille. The study, which included students without visual impairments, students with blindness, and students with low vision, found that all groups preferred completing printed tests (in standard font size, enlarged font size, or braille) over orally-delivered tests, indicating that doing so permitted them to engage directly with the material at their own rate. Only one student with blindness and two students with low vision preferred oral delivery, noting that it was easier and quicker; one low-vision student had no preference.
- A survey of teachers of the visually impaired found that teachers' philosophy of reading affected the number of options a student was likely to have for accessing an assessment. Students whose teachers put a high value of sounding out words were more likely to have accommodations other than braille (e.g., screen readers, large print) (Johnstone et al., 2009).

What have we learned overall? Students with visual disabilities have benefited from reading braille versions of assessments. Students accustomed to reading braille might prefer it over oral test delivery. Braille can be provided in combination with other accommodations, such as extended time or separate setting. Some tests or individual test items might interact in problematic ways with braille coding, affecting the accuracy of braille users' scores. Braille should be taken into consideration throughout the test development process, including development of test forms and the rendering of items into other forms.

There is a need for additional research on braille as an assessment accommodation, particularly research on refreshable braille. Much of the research on this accommodation was conducted more than a decade ago and no recent studies were identified which addressed refreshable braille.

Footnotes

[1]

Research on braille summarized here is also available in NCEO's searchable *Accommodations for Students with Disabilities Bibliography* (https://nceo.info/Resources/bibliographies/accommodations/bibliography) and in NCEO syntheses of research from 1999 through 2018 (see summaries for: 1999-2001 (https://nceo.umn.edu/docs/OnlinePubs/TechReport34.pdf), 2002-2004 (https://nceo.umn.edu/docs/OnlinePubs/Tech45/Technical45.pdf), 2005-2006 (https://nceo.umn.edu/docs/OnlinePubs/Tech47/TechReport47.pdf), 2007-2008 (https://nceo.umn.edu/docs/OnlinePubs/Tech56/TechnicalReport56.pdf), 2009-2010 (https://nceo.umn.edu/docs/OnlinePubs/Tech65/TechnicalReport65.pdf), 2011-2012 (https://nceo.umn.edu/docs/OnlinePubs/Synthesis94/Synthesis94.pdf), 2013-2014 (https://nceo.umn.edu/docs/OnlinePubs/Report402/NCEOReport402.pdf), 2015-2016 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport412.pdf), 2017 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport418.pdf), 2018 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport423.pdf), 2019 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport433.pdf). See the reports and online bibliography for additional information about the criteria used to identify studies included in this fact sheet.

[2]

This fact sheet does not address Grade 3 braille which is akin to shorthand, is not standardized, and is not used in publications included in this review.

References

Bolt , S. E. (2004). Examining empirical evidence for several commonly held beliefs and disputes about testing accommodations. *Dissertation Abstracts International: Section A. Humanities and Social Sciences*, *65*(05). Retrieved from http://search.proquest.com/docview/305157951/abstract

Erin, J. N., Hong, S., Schoch, C., & Kuo, Y. (2006). Relationships among testing medium, test performance, and testing time of high school students who are visually impaired. *Journal of Visual Impairment & Blindness*, *100*(9), 523–532. Retrieved from http://www.afb.org/jvib/jvib_main.asp

Fox, L. A. (2012). Performance of students with visual impairments on high-stakes tests: A Pennsylvania report card. *Dissertation Abstracts International: Section A. Humanities and Social Sciences*, 74(03). Retrieved from http://d-scholarship.pitt.edu/13954/1/foxla_etdPitt2012.3.pdf

Jackson, L. M. (2003). The effects of testing adaptations on students' standardized test scores for students with visual impairments in Arizona. *Dissertation Abstracts International: Section A. Humanities and Social Sciences*, *64*(10). Retrieved from http://search.proquest.com/docview/305336702/abstract

Johnstone, C., Thurlow, M., Altman, J., Timmons, J., & Kato, K. (2009). Assistive technology approaches for large-scale assessment: Perceptions of teachers of students with visual impairments. *Exceptionality*, *17*(2), 66–75. https://doi.org/10.1080/09362830902805756

Kamei-Hannan, C. (2008). Examining the accessibility of a computerized adapted test using assistive technology. *Journal of Visual Impairment & Blindness*, *102*(5). Retrieved from http://www.afb.org/jvib/jvib_main.asp

Stone, E., Cook, L., Laitusis, C. C., & Cline, F. (2010). Using differential item functioning to investigate the impact of testing accommodations on an English-language arts assessment for students who are blind or visually impaired. *Applied Measurement in Education*, *23*(2), 132–152. https://doi.org/10.1080/08957341003673773

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